

Unit-I:

Thermodynamics: Thermodynamic System, Equilibrium, Thermodynamic laws and their applications. Different types of processes, Thermodynamic variables and Entropy. Thermodynamic potentials and relations, Maxwell's Equations, Fundamental equation of heat flow.

Unit-II:

General Biophysical methods: Measurement of pH, Radioactive labeling & counting, Autoradiography. Diffusion, Sedimentation, Osmosis. Viscosity- definitions, factors influencing them and their applications in biology.

Bragg's equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure.

Unit-III:

Fundamentals of Biochemistry: Biochemistry as molecular logic of living beings, Axioms of living matter, Major organic compounds of animate objects a general view. Chemical elements, structure of atoms, molecules and chemical bonds. Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water, Water as universal solvent, Acids, bases and salts, pH and buffers.

Unit-IV:

Biomolecules: Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.

Unit-V:

Enzymes: Structure, classification and function -Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km- Michaelis Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot. Introduction to Allosteric Enzymes. Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples. Concept of ribozyme, multiple forms, isozymes and abzymes.

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Paper-II: Bioinstrumentation, Biostatistics and Bioinformatics

Unit-I:

Microscopy – Light, Phase contrast, fluorescence and Electron microscopy
Centrifugation technique. Principles types & separation of biological molecules.

Unit-II:

Chromatography and Electrophoresis

Chromatography: Principles and applications, Principle and application of electrophoresis.
Agarose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.

Unit-III:

Spectrophotometry.

Colorimetry (UV and Visible), Radio and Non radio labelling, Autoradiography

Unit-IV:

Biostatistics- Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation. Probability, definition. Random variable and its distribution. Binomial probability distribution.

Unit-V:

Computers: General introduction (characteristics, capabilities, generations), hardware: organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), internet application.

Basic Bioinformatics: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Biological Databases: Sequence databases (EMBL, GenBank, DDBJ, UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc).

Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

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B.Sc III Year**Paper-I: Molecular Biology and Genetic Engineering****Unit-I:**

DNA and RNA, Chemical Structure, Types and Properties. Experimental Proof of DNA as genetic material, Genome- Concept, Plant, Animal, Bacterial and Viral Genome. DNA Replication. Types, Experimental proof of semi conservative replication, Replicon- Concept, proteins and enzymes involved in replication in prokaryotes and eukaryotes, Modes of DNA replication. Unidirectional, Bidirectional, Types of DNA replication. Y shaped, θ mode, rolling circle mechanism.

Unit-II:

Eukaryotic chromosomal organization, Euchromatin, Heterochromatin, chromatin structure, nucleosomes, histone and non histone proteins, Histone modifications, Introduction to epigenetics.

Unit-III:

Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules, Evolution of early forms, Mendelian genetics: Mendel's Law, Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.

Unit-IV:

Introduction to Recombinant DNA technology, Scope & importance, Gene Cloning, PCR, Introduction to Restriction endonuclease, Vectors for DNA transfer and their types: Plasmids, Phagemids, Cosmids, BAC. Gene amplification.

Unit-V:

Plasmids Types Properties and cloning vectors. Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA.

Mutation, Types of mutations; Point mutation (Base pair change, frame shift, deletion).

Transcription, translation and gene expression in eukaryotes (yeast), Alternate splicing.

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Paper-II: Applied Biotechnology

Unit-I: Microbial Biotechnology

Food Microbiology-Microbial contamination & Spoilage, Food preservation. Industrial Production of Ethyl Alcohol, Penicillin, Cyanocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.

Unit-II: Plant Biotechnology-

Introduction to plant tissue culture, Nutritional requirements, In vitro culture. Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis . Protoplast culture. Somatic hybridization, Genetic manipulation of plants using *Agrobacterium tumefaciens*.

Unit-III: Immunology and Animal Biotechnology

Immunity- Innate and Acquired, Host defense mechanism- Infection and its types, Organs and Cells of Immune system, Vaccines and its types. Antigens- Properties and types, Adjuvants, Immunoglobulins- Structure, types and functions. Generation of Antibodies, Primary and Secondary response, Agglutination and Precipitation reactions.

History , Equipment and materials for animal cell culture technology. Physical requirement for animal cell and their growth curve in culture.

Commonly used cell lines – their organization and characteristics, Differentiation of cells. Organ culture – techniques, advantage and applications.

Applications of animal biotechnology: Methods of Transfection and cell fusion of animal cells, Selectable markers, HAT selection, Transgenic animals, Stem cell culture. Transplantation of cultured cells, Bioreactors for large scale production of animal cells.

Unit-IV: Fermentation Technology

Fermentation Technology, Primary and Secondary Screening, Strain Improvement, Inoculum Development, Industrial Sterilisation process, Scale-up and Harvest and Recovery.

Types of fermentation – batch, continuous, fed batch process: Submerged and Solid State fermentation process, Basic design of a fermentor and factors affecting fermentor design.

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Types of fermentors- Fluidized, Packed Bed, Air lift Fermentor, Tray Fermentor and Tower Fermentor.

Unit-V: Environment Biotechnology

Environment: Basic concept, Significance, Public awareness, Environmental pollution, Assessment of water quality, Treatment of waste-water – Primary, secondary and tertiary treatment. Solid waste management (composting, vermi-composting, methane production). Biopesticides- Bacterial and Fungal, Genetically modified crops, Biofertilizers - Nitrogen fixers, PSB, Mycorrhiza and VAM; Microbial leaching, Microbial Enhanced Oil Recovery. Bioremediation and Biodeterioration. Modern fuels- Methanogenic bacteria and biogas, microbial hydrogen production.

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Kajal

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